



601 Pennsylvania Ave., NW
Suite 800
Washington, DC 20004
202-654-5900

February 8, 2018

VIA ELECTRONIC FILING

Ms. Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

Re: *Ex Parte Notification*

GN Docket No. 17-258, *Promoting Investment in the 3550-3700 MHz Band*;

GN Docket No. 17-183, *Expanding Flexible Use in Mid-Band Spectrum Between 3.7 and 24 GHz*; and

GN Docket No. 14-177, *Use of Spectrum Bands Above 24 GHz for Mobile Radio Services*

Dear Ms. Dortch:

On February 7, John Hunter of T-Mobile, Russell Fox of Mintz Levin, and I conducted meetings with: Umair Javed, legal advisor to Commissioner Rosenworcel; Will Adams, legal advisor to Commissioner Carr; and members of the staffs of the Office of Engineering and Technology, Wireless Telecommunications Bureau, and International Bureau shown in the attachment to this letter. On February 7, we met with Rachael Bender, legal advisor to Chairman Pai. We distributed the attached presentation at each meeting and discussed the above-referenced proceedings.

3.5 GHz

Other countries have designated the 3550-3700 MHz band (“3.5 GHz band”) for Fifth Generation wireless (“5G”) services. In order to help preserve U.S. leadership in the race to deploy 5G, it is imperative that the Commission adopt rules that provide the certainty and structure necessary to drive investment in use of the 3.5 GHz band, both to develop technology and to deploy infrastructure. T-Mobile supports changes that preserve the three-tier sharing structure while making adjustments to use of the 3.5 GHz band spectrum that will be available on a licensed basis. The Commission should move quickly to adopt these changes and to initiate the process of auctioning the 3.5 GHz band in 2018.

License Terms. In particular, we noted that the Commission should issue licenses with a standard 10-year term and a renewal expectancy. Both of those features are critical to attracting investment in the band, which is necessary to make it a success – for licensed users and those seeking General Authorized Access (“GAA”) use. As the Commission’s rules that govern other services demonstrate, 10-year license terms are necessary to permit entities to take all the steps required – developing and optimizing technology, securing antenna siting – and necessary to provide a robust service. A full license term will best allow providers in rural, urban, small or large market to succeed.

Geographic Area Size. We also urged the Commission to reject the use of census tracts to license 3.5 GHz band spectrum. As T-Mobile demonstrated in its reply comments in this proceeding, the use of census tracts will materially impair licensees’ ability to use their authorized spectrum – and the ability of spectrum access system (“SAS”) administrators to manage the spectrum for *both* licensed and GAA users – because of the number of geographic area borders created.^{1/} This problem is exacerbated in urban areas, where the number of census tracts – often *thousands* per partial economic area (“PEA”) – will make spectrum management impossible. These same significant engineering challenges exist even under a county-based licensing approach, particularly in urban areas where a large number of counties are still required to serve an economic area. While T-Mobile believes that PEAs provide an appropriate geographic license size for licensing the spectrum throughout the country, it also recognizes that some entities are concerned about the size of the PEA, particularly in more rural areas. Accordingly, T-Mobile suggested that the Commission address the competing concerns by adopting a hybrid approach. In particular, it should issue Priority Access Licenses (“PALs”) on a PEA basis in the top 115 PEAs, by population. In the remainder of the country, the Commission should issue licenses on a county basis. Issuing licenses on a county basis enjoys support in the record, with parties recognizing that they represent a better outcome than census tract licensing.^{2/}

T-Mobile recognizes that there are some entities that may wish to use 3.5 GHz band spectrum in more limited areas.^{3/} GAA spectrum can be used to meet those needs. For others, that require the certainty that licensed spectrum provides, market transactions with licensees will enable consistent availability of capacity. Multiple commenters in this proceeding have suggested means to promote secondary market transactions. Commenters suggested allowing SAS administrators, rather than the Commission, to facilitate secondary market spectrum leasing

^{1/} Reply Comments of T-Mobile USA, Inc., GN Docket No. 17-258, at 26-27 (filed Jan. 29, 2018).

^{2/} See Comments of NCTA – The Internet & Television Association, GN Docket No. 17-258, at 4 (filed Dec. 28, 2017) (“By reducing the total license areas from 74,000 census tracts to approximately 3,150 counties, the Commission would reduce auction complexity and significantly simplify license management burdens and border coordination issues.”); Comments of Comcast, GN Docket No. 17-258, at 5 (filed Dec. 28, 2017); Comments of NTCA – The Rural Broadband Association, GN Docket No. 17-258, at 8 (filed Dec. 28, 2017).

^{3/} See, e.g., Comments of General Electric Company, GN Docket No. 17-258, at 3-4 (filed Dec. 28, 2017); Comments of Motorola Solutions, Inc., GN Docket No. 17-258, at 2-4 (filed Dec. 28, 2017); Comments of the American Petroleum Institute and Energy Telecommunications and Electrical Association, GN Docket No. 17-258, at 3 (filed Dec. 21, 2017).

arrangements.^{4/} Because this light-touch approach would enable pre-certification and immediate processing, it would minimize the costs and administrative burdens typically associated with such transactions and streamline access to spectrum, while simultaneously offering some regulatory oversight.^{5/} Commenters also supported an approach under which PAL licensees may divide their service areas into used and unused areas and allow lessees, on their own, to coordinate use of the unused areas.^{6/} Both suggestions offer better alternatives than potentially making the entire 3.5 GHz band unusable through the use of too-small license areas to accommodate a single business plan.

Mid-Band Spectrum

The 3.5 GHz spectrum that the Commission has already designated for terrestrial wireless use is a good step toward making mid-band spectrum available for 5G operations. But even if the Commission takes the actions that T-Mobile and others recommend, the use of the band will be limited. For example, facilities using so-called Category B antennas will be restricted to a maximum EIRP of 47 dBm/10 megahertz (or 50W), while those using Category A antennas will be limited to a maximum EIRP of 30 dBm/10 megahertz (1W).^{7/} This is compared to the typical power of 60 dBm (1000W). That is why the Commission must go further and make additional mid-band spectrum available for terrestrial mobile use under typical licensed spectrum parameters. Doing so will ensure that the U.S. remains in step with other countries in designating mid-band spectrum for terrestrial wireless use. The Commission should therefore adopt a Notice of Proposed Rulemaking proposing the use of the 3.7-4.2 GHz band for terrestrial mobile broadband.

Incumbent Use of the Mid-Band Spectrum. The 3.7-4.2 GHz band is ideal for supporting 5G mid-band operations. Among other things, it is adjacent to the 3.5 GHz band, potentially permitting 650 megahertz to be used for mid-band networks. T-Mobile recognizes that the Commission must address current incumbent uses of the band. As an initial step, the Commission should issue a Public Notice seeking additional information about satellite earth station use of the spectrum. As others have pointed out, under the full-band, full-arc licensing approach, every earth station is assumed to use all of the spectrum and communicate with the full arc of satellites, even though it may use only a small fraction of the spectrum and communicate with a single satellite. In addition, there is evidence in the record that some licensed earth stations may no longer even exist.^{8/}

^{4/} See Comments of NCTA – The Internet & Television Association, GN Docket No. 17-258, at 11 (filed Dec. 28, 2017); Comments of Verizon, GN Docket No. 17-258, at 15 (filed Dec. 28, 2017).

^{5/} Comments of Federated Wireless, GN Docket No. 17-258, at 6-8 (filed Dec. 28, 2017); Comments of Ruckus Networks, at 16 (filed Dec. 28, 2017).

^{6/} Verizon Comments at 16.

^{7/} See 47 C.F.R. § 96.41.

^{8/} See Comments of Nokia, GN Docket No. 17-183, at 7 (filed Oct. 2, 2017); Comments of CTIA, GN Docket No. 17-183, at 9 (filed Oct. 2, 2017); Reply Comments of Verizon, GN Docket No. 17-183, at 4 (filed Nov. 15, 2017).

Intel and Intelsat have suggested one method of potentially transitioning the spectrum for terrestrial 5G use.^{9/} But that approach will not assure that the spectrum will ever be converted to terrestrial use. Even if incumbents wished to engage in secondary market transactions, the limited number of satellite operators may result in monopoly pricing of the spectrum for terrestrial use. In order to more effectively begin the process of transitioning at least some of the band for terrestrial operations, the Commission should establish a band plan and conduct an auction for the majority of the spectrum in the band on a nationwide basis. The Commission may then permit incumbent satellite operators to use market mechanisms to retain or sell the remainder of the band for terrestrial use, conditioned upon their assistance in clearing the auctioned segment of the band (with clearing costs paid or reimbursed by auction winners). T-Mobile's proposed approach provides the certainty necessary to make the band available in a way that drives investment and deployment of services. T-Mobile has suggested guidelines under which the Commission may evaluate a hybrid approach to make the 3.7-4.2 GHz band available for wireless mobile broadband use.^{10/}

Spectrum Frontiers

Finally, we discussed the need to move quickly to auction the millimeter wave bands allocated for terrestrial mobile use in the *Spectrum Frontiers* proceeding. These include the 24 GHz, 28 GHz, 37 GHz, 39 GHz and 47 GHz bands. T-Mobile is well positioned to launch 5G services in this high-band spectrum, but the Commission must act to make this additional spectrum available to ensure that consumer expectations can be met. Auctioning the spectrum together is particularly important because much of the 28 GHz and 39 GHz bands is already licensed.^{11/} Auctioning all bands together will result in a more robust and competitive auction. In contrast, auctioning only the 28 GHz and 37/39 GHz bands now will further entrench the precise entities that have already established a strong presence in the band and permit limited opportunities for new entrants to the millimeter wave bands. This will stifle competition.

AT&T Voucher Proposal. We noted that AT&T recently submitted a proposal to rationalize the 38.6-40 GHz band, in which licensees often hold spectrum in non-contiguous blocks, potentially reducing the benefit of the band for wider-bandwidth applications.^{12/} T-Mobile appreciates the benefits of the AT&T proposal – which would employ market mechanisms to reconfigure the

^{9/} See Comments of Intelsat and Intel, GN Docket No. 17-183, at 16-17 (filed Oct. 2, 2017).

^{10/} See Reply Comments of T-Mobile USA, Inc., GN Docket No. 17-183, at 16-17 (filed Nov. 15, 2017).

^{11/} See *Application of Celco Partnership d/b/a Verizon Wireless and XO Holdings For Consent to Transfer Control of Local Multipoint Distribution Service and 39 GHz Licenses*, Memorandum Opinion and Order, 32 FCC Rcd 10125 (rel. Nov. 29, 2017); *Application of Verizon Communications Inc. and Straight Path Communications, Inc. For Consent to Transfer Control of Local Multipoint Distribution Service, 39 GHz, Common Carrier Point-to-Point Microwave, and 3650-3700 MHz Service Licenses*, Memorandum Opinion and Order, DA 18-52 (rel. Jan. 18, 2018); *Application of AT&T Mobility Spectrum LLC and FiberTower Corporation For Consent to Transfer Control of 39 GHz Licenses*, DA 18-125 (rel. Feb. 8, 2018).

^{12/} Letter from Alex Starr, AT&T Services, Inc., to Marlene H. Dortch, Secretary, FCC, GN Docket No. 14-177 (filed Dec. 12, 2017).

band in a manner to make its potential use more effective. But, as Verizon pointed out, the plan has limitations.^{13/} For example, a licensee with only a single license will receive a voucher for less than the value of the 200 megahertz channels that will be authorized at auction. That means that an incumbent licensee may be required to bid an amount higher than its voucher value to retain its spectrum (that would be embedded in a larger-block license).^{14/} Similarly, the AT&T plan does not fully address the Commission's authority to redeem vouchers that are not used for cash. Moreover, the Commission itself proposed the outlines of a plan to rationalize the 38.6-40 GHz band, but it has taken no steps to implement its approach.^{15/} While T-Mobile believes that the voucher proposal has merit, and could be used as basis to renationalize spectrum across multiple bands, all of these matters must be resolved prior to the Commission conducting an auction for the spectrum. T-Mobile urges the Commission to auction millimeter wave spectrum as quickly as possible, preferably in 2018. If the issues regarding the 39 GHz band cannot be resolved in that time frame, the Commission may wish to conduct a millimeter wave auction without that spectrum so that access to other bands is not delayed.

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Pursuant to Section 1.1206(b)(2) of the Commission's rules, an electronic copy of this letter is being filed in the above-referenced dockets and a copy is being provided to each member of the Commission's staff with whom we met. Please direct any questions regarding this filing to me.

Respectfully submitted,

/s/ Steve B. Sharkey

Steve B. Sharkey

Vice President, Government Affairs
Technology and Engineering Policy

Attachment

cc: (each with attachment)
Rachael Bender
Umair Javed
Will Adams
All Commission staff on attached (each electronically)

^{13/} Letter from Gregory M. Romano, Vice President & Associate General Counsel, Verizon, to Marlene H. Dortch, Secretary, FCC, GN Docket No. 14-177 (filed Jan. 25, 2017).

^{14/} One way for the Commission to address this issue is to re-visit the size of the spectrum blocks so that incumbent licensees can bid on only what they currently hold. A 50 megahertz size block would be consistent with the minimum size contemplated by 3GPP standards. While T-Mobile has supported the use of 200 megahertz blocks where feasible, the presence of incumbents in this band may make it unattractive to conduct an auction using that block size.

^{15/} *Use of Spectrum Bands Above 24 GHz For Mobile Radio Services, et al.*, Report and Order, GN Docket No. 14-177, et al., 31 FCC Rcd 8014, ¶¶ 98-100 (rel. July 14, 2016).

Wireless Telecommunications Bureau

Donald Stockdale

Joel Taubenblatt

Margaret Wiener

Blaise Scinto

John Schauble

Peter Daronco

Gary Michaels

Peter Trachtenberg

Martha Stancill

Paul Powell

Erik Salovaara

Matthew Pearl

Simon Banyai

Jessica Greffenius

Ariel Diamond

Office of Engineering and Technology

Julius Knapp

Michael Ha

Walter Johnston

Nicholas Oros

Barbara Pavon

Bahman Badipour

Brian Butler (by phone)

International Bureau

Thomas Sullivan

Jim Schlichting

Robert Nelson

Jose Albuquerque

Diane Garfield

Christopher Bair



5G Spectrum Leadership

3.5 GHz, Spectrum Frontiers, Mid-
Band Proceedings

February 2018

Agenda



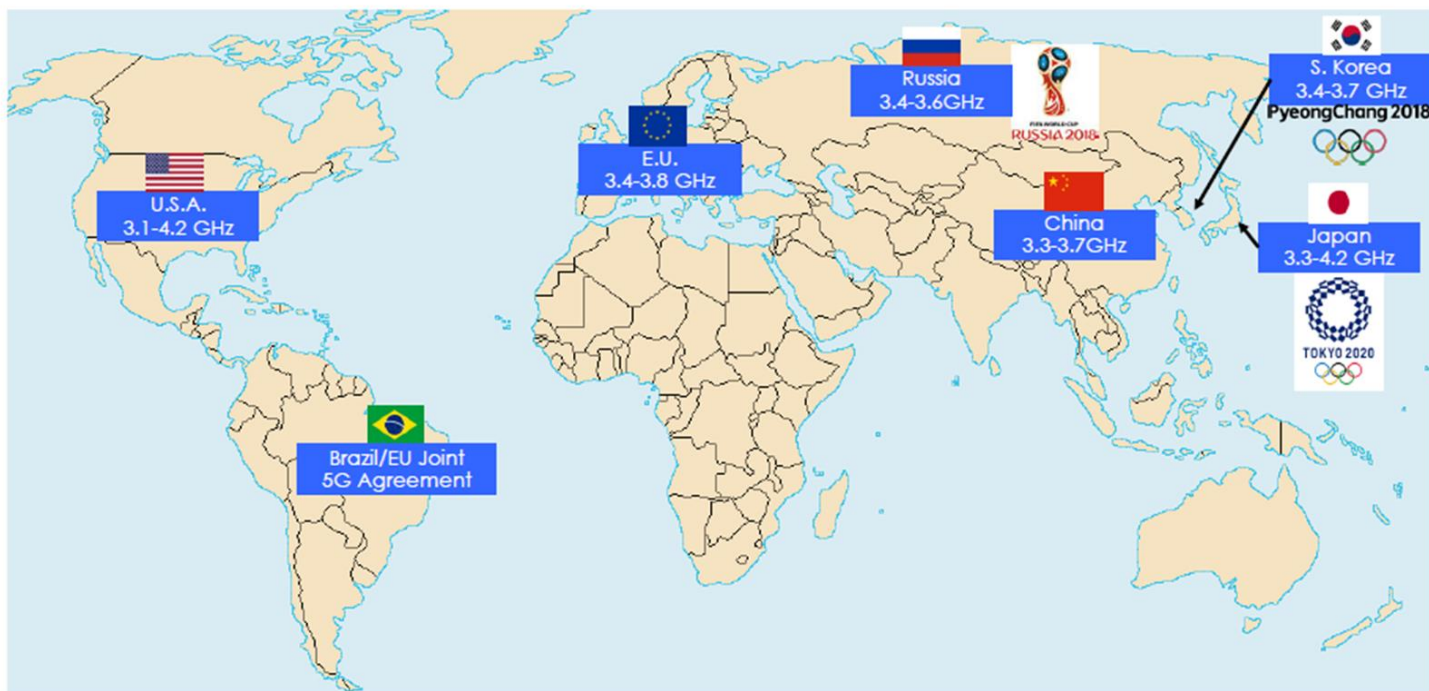
- ❑ 3.5 GHz CBRS Band
 - License Size and Duration

- ❑ Mid-Band Proceeding
 - 3.7-4.2 GHz Band

- ❑ Spectrum Frontiers
 - Auction
 - AT&T Voucher

3.5 GHz Band

- ❑ The 3.5 GHz band is already diminished in its utility as a 5G band when compared internationally
 - Countries licensing optimized for macro layer

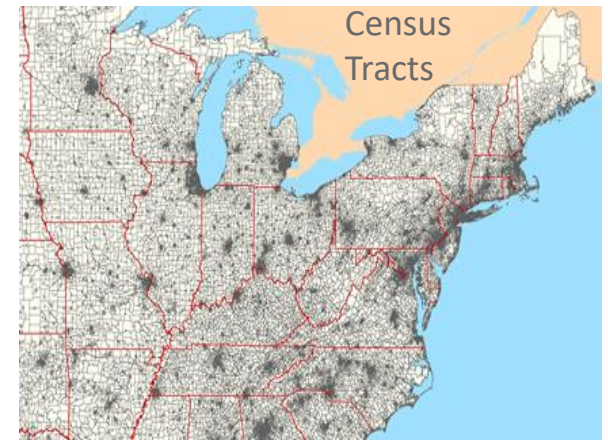


Only Standard License Terms and Size Will Attract Investment



- ❑ The Commission is correct to seek changes to modify the band's framework to better support 5G services
- ❑ Ten year license terms with renewal expectancy is critical.
 - No entities – big or small, rural or urban – will invest without assurance that they can recoup those investments over time through additional license terms
 - An abbreviated license term will not provide entities with sufficient time to build out systems. All FCC-issued geographic area licenses have longer license terms
 - Those terms recognize, among other things, the challenges with technology development, antenna siting and other obstacles to introducing service
- ❑ Larger license sizes are also important, both from an economic and technical perspective
 - Larger license areas will give providers more customer opportunities – making the provision of service throughout the area more economically viable
 - Smaller license sizes impede use of the spectrum throughout the geographic area

Boundary Issues With Census Tracts



PEA	PEA Number	Number of Counties in PEA	Number of Census Tracts in PEA
New York, NY	1	42	6,023
Los Angeles, CA	2	8	4,212
Chicago, IL	3	12	2,199
San Francisco, CA	4	13	1,960
Baltimore, MD – Washington, DC	5	26	1,909
Salmon, ID	407	3	5
Ballinger, TX	408	3	7
Haskell, TX	409	5	7
Valentine, NE	410	3	5
Van Horn, TX	411	2	2

3.5 GHz CBRS Issues Using Smaller License Sizes

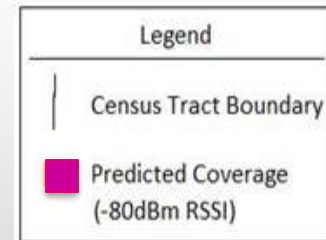
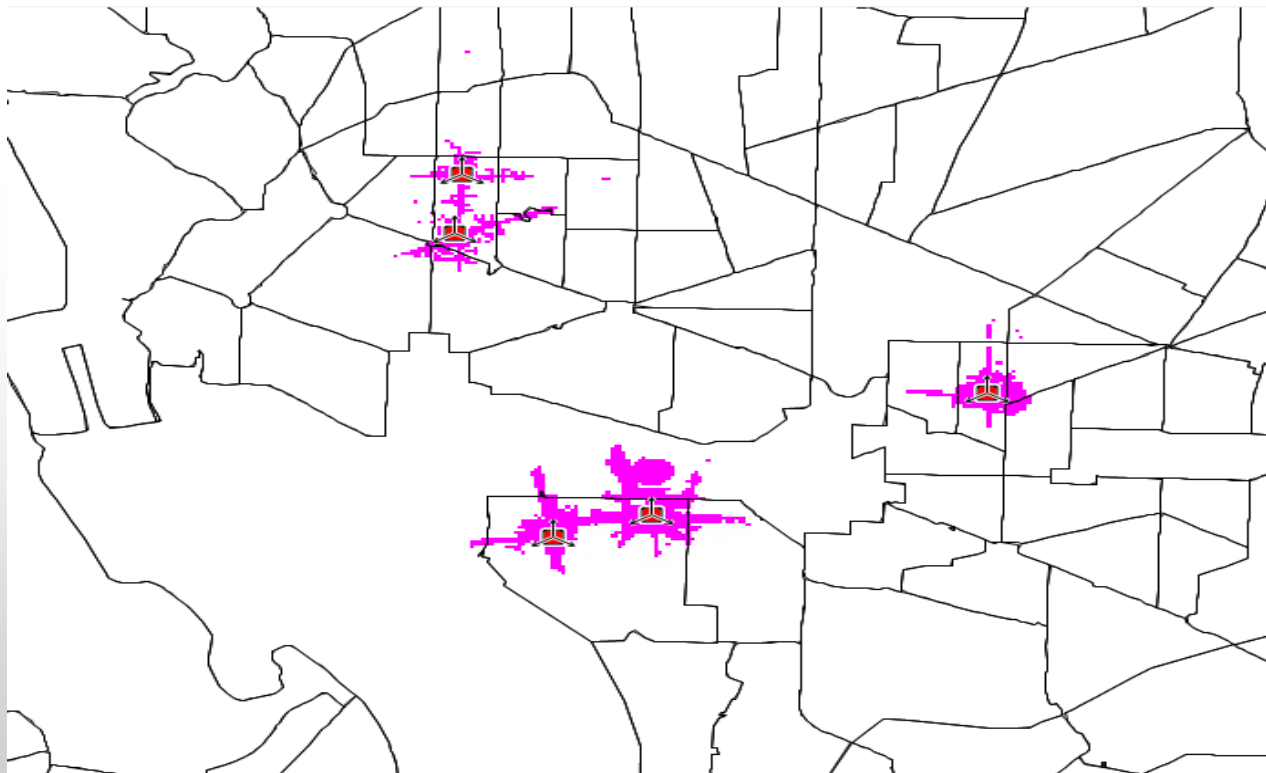
- ❑ Census tract concerns – 73,800 unique areas
- ❑ Extensions agreements are not feasible with so many linear square miles of shared boundaries

Political Boundary	Border Length (Miles)
Census Tract	1,465,038.27
County	536,857.37
PEA	221,955.66

- ❑ Current rule: signal strength at any PAL boundary from adjacent PAL or GAA area may not exceed -80 dBm in 10 MHz
- ❑ Channel reuse to manage interference is significantly degraded
- ❑ SAS will not be able to assign available channels even if neighboring licenses are compliant with license co-channel boundary emission rules

Census Tracts - Multiple Locations

- ❑ Multiple site prediction at max power (47 dBm EIRP)
- ❑ Even with 3.5 GHz propagation characteristics some urban areas will be underserved due to boundary level license compliance attenuation efforts, such as reduced power, antenna tilts and removed sectors



Conclusion – 3.5 GHz Band

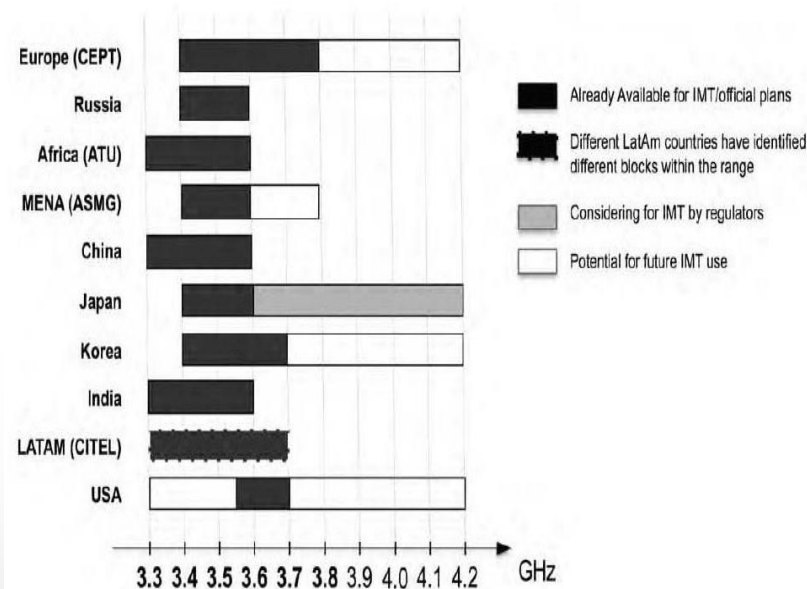


- ❑ With small license areas, RF is difficult to control at the border due to the RF propagation tunneling effect caused by building reflection
- ❑ This analysis was performed on a medium to larger sized census tract. Expect these effects to be magnified when seen in smaller tracts, especially within dense urban environments like New York City
- ❑ Using census tracts in the 3.5 GHz band is technically impractical, and will greatly diminish the CBRS band
- ❑ PALs, *and* GAA, will both suffer unnecessarily using census tracts, with GAA taking the brunt of the impact given it operates at the third tier

3.7-4.2 GHz Mid-Band Proceeding

- ❑ The Mid-Band proceeding is critically important to support mobile 5G, especially when you consider:
 - The 3.5 GHz CBRS band, a band identified globally to support 5G, is greatly impaired to support 5G services due to low power, licensing regime and sharing structure
 - Given the 3.5 GHz CBRS constraints, now more than ever the 3.7-4.2 GHz band must be made available to support mid-band 5G
 - Other countries are moving forward with more traditional mechanisms to make mid-band spectrum available for mobile 5G

Figure 4: 3300-4200 MHz globally – some regional and national preferences.



SOURCE: GSA - THE FUTURE OF IMT IN THE 3300-4200 MHz FREQUENCY RANGE, June 2017
<http://www.communicationstoday.co.in/images/reports/20171011-The-Future-of-IMT-in-the-3300-4200-MHz-range.pdf>

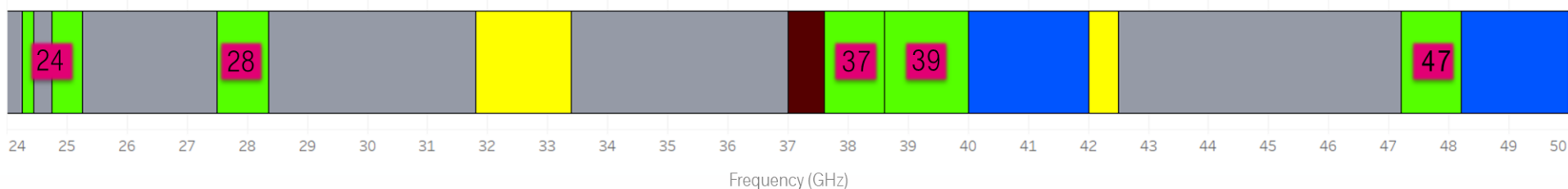
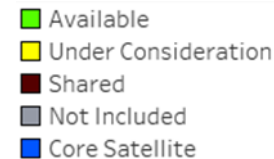
3.7-4.2 GHz Mid-Band Proceeding



- ❑ 3.7-4.2 GHz Band -- Key focus for mobile 5G use
 - Spectrum must be made available in a manner that maximizes the amount of spectrum cleared of incumbents
 - T-Mobile has concerns with Intel/Intelsat proposal
 - Incumbents can limit supply and impose monopoly pricing
 - No certainty regarding availability of spectrum
 - Need a more transparent and organized process for making spectrum available
 - T-Mobile proposed a hybrid approach - traditional auction mechanism for most of the band, and giving terrestrial rights to incumbents for remainder of the band in exchange for clearing auctioned portion.
- ❑ The Commission should move forward to issue a Notice of Proposed Rulemaking (NPRM) ASAP

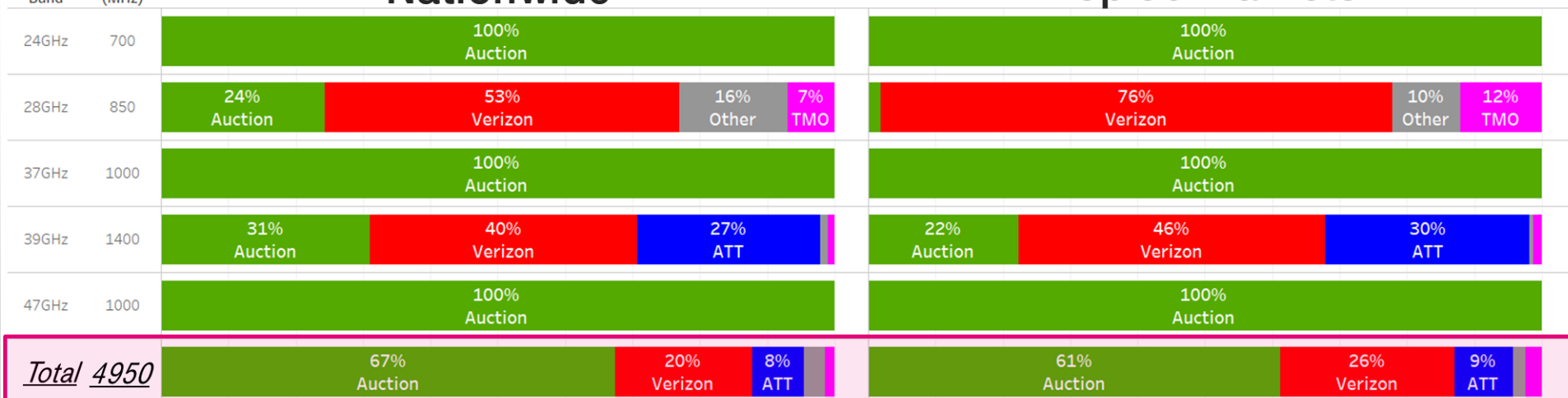
Spectrum Frontiers

- ❑ The 24, 28, 37, 39, & 47 GHz bands should be auctioned together as quickly as possible
- ❑ With the limited amount of spectrum left in 28 and 39 GHz bands, auctioning only those bands will further consolidate holdings at the expense of competition



Nationwide

Top 50 Markets



Spectrum Frontiers – Rationalizing the 39 GHz Band



- ❑ The Commission correctly recognized that the 39 GHz band should be rationalized to permit more contiguous spectrum use.
- ❑ The *Report and Order* had broad outlines – but no specifics -- for one approach and AT&T has suggested another.
- ❑ The AT&T voucher plan is attractive because it would use market mechanisms to rationalize the band. If the Commission proceeds it will be required to address –
 - The disconnect that Verizon notes between the size of the voucher spectrum vs. size of auctioned blocks (perhaps consider licensing using 3GPP-contemplated 50 megahertz blocks)
 - The process for paying licensees that do not use their vouchers
- ❑ If voucher approach is adopted, licensees should be able to use voucher across all auctioned bands.
- ❑ Any approach that preserves existing licensee rights must address the fact that some new licenses will have both geographic area and RSA incumbents.